SOIL SURVEY OF THE PARSONS AREA, KANSAS.

By J. A. DRAKE.

LOCATION AND BOUNDARIES OF THE AREA.

The Parsons area lies in the southeastern part of Kansas, having for its southern boundary the Kansas-Indian Territory boundary line. The area has an extent of 398 square miles, and embraces the eastern part of Labette County, a small part of western Cherokee County, and the southwestern part of Crawford County. The Neosho River, with its broad bottom lands, extends through the area from north to south.

During the early part of this survey Mr. Frank Bennett, jr., was in charge of the work, but was later transferred to another area. The

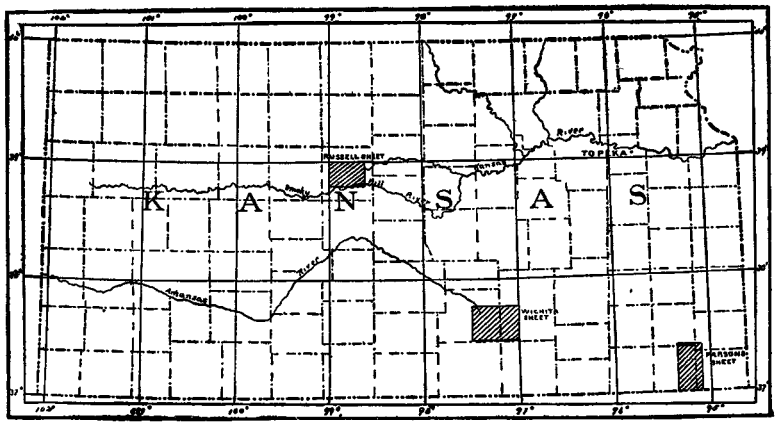

FIG. 44.—Sketch map showing location of the Parsons area, Kansas.

chapter on geology of the area is founded on a report on this subject issued by the University of Kansas; that on history is largely taken from the history of Labette County, by Hon. Nelson Case. Much material for this part of the report, however, was gathered by personal interview with the author of that work.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The early history of the area surveyed has to do with two important Indian tribes, the Cherokees and the Osages, who owned the country

prior to the advent of the first white settlers. The Cherokees owned but did not inhabit the part of the area lying in Cherokee and Crawford counties, and the Osages occupied the part in Labette County.

In 1865 the first settlers began to come to the land of the Osages, others having reached that of the Cherokees a few years earlier. In 1866 the Cherokees disposed of their territory, through the Joy Purchase, to the American Immigrant Company, and the Osages sold their land to the Government in June of the same year, although it was not until four years later that they removed to Indian Territory.

The settlers were beginning to be attracted to the Joy Purchase lands under the impression that these were Government lands and could either be bought at a very low price or homesteaded, and for several years this was the cause of much controversy, causing many feuds before the rights of the company came to be recognized. The matter was finally settled in 1870.

During this period the condition of the country was very unsettled. The people simply squatted on the lands and made no attempt to improve them or to build permanent houses, but waited until they could obtain a clear title. They were finally forced to buy the land, paying from $2 to $5 an acre for it. Many left the country on this account and this greatly retarded its development.

A similar controversy, with a similar, though worse, effect, arose between the settlers of Labette County and the Missouri, Kansas and Texas Railway, which claimed, through a former treaty, a right to every alternate section of land for 10 miles on each side of the track. In 1875, after a long fight, the case was decided in the Supreme Court in favor of the settlers, after which the country assumed a more settled state and began a healthy growth.

Upon the settlement of the Joy Purchase dispute and the removal of the Osage Indians, immigrants began to come in quite rapidly from all parts of the country, and especially from Illinois, Indiana, Ohio, Iowa, and Tennessee. These pioneers were generally of the poorer class, bringing with them only the bare necessaries of life and their teams, and there was at first considerable suffering among them.

The Missouri, Kansas and Texas Railway was built in 1870. Up to this time all food and other supplies, except those produced at home, had to be hauled from points in Missouri over bad roads and across many streams difficult to ford. The St. Louis and San Francisco Railroad was built in 1876, connecting this country with St. Louis. Since that time the railroad facilities have been good, but this has produced no phenomenal growth in the country, as the census reports show.

The development of agriculture in this section has been slow. The general character of the first settlers and their early environment were not conducive to a healthy and rapid growth of this most important

industry. While the main body of the settlers were intelligen , industrious, and good citizens, they were generally men of moderate means, such as bring little into a country to build it up.

The virgin soils produced but scantily for several years. The country abounded in rich stores of game and forage. Cattle were fed but little, and hogs were allowed to run and fatten on mast. The chief pursuits were hunting and trading with the Indians. All this, together with the unsettled condition of land titles, was unfavorable to the development of agriculture, and the effect of these early conditions has been far-reaching.

In 1866 the area was visited by hordes of grasshoppers, and the future looked discouraging for the farmer, but there was no further trouble from this pest until September, 1874. In that year whole fields of corn were destroyed in a single day. Everything green was eaten. The next spring they kept all crops eaten down till about June, when they disappeared. In 1876 they appeared again, but did not seriously damage the crops.

In the fall of 1866 the first wheat was sown in the area. The next year several farmers began to grow this crop, and in 1868 the first mill equipped to grind wheat began operations. Since that time the acreage and production have greatly increased.

The first hay made from cultivated grass is said to have been marketed as early as 1873. At that time, however, and until recently, very few farmers attempted to grow tame grasses, depending on the prairie grasses for their hay and pasture.

In 1873 cotton was introduced among the farmers along Labette Creek, and a cotton gin was erected. This ceased to operate after two or three years; but in 1879 another gin was built, this time at Oswego. The yields of this crop were large and profitable, although the acreage was never large. In 1880, 98 bales were ginned at this place, and the next year 145 bales were produced. Although this crop is said to have grown well, an occasional wet fall and expensive labor have since caused it to be abandoned.

Up to about 1880 cattle raising was an important feature of the agriculture of the county. Large tracts of land were used in connection with the pasture lands in Indian Territory. Cattle were summered there and brought north to this section to winter, where corn and hay could be had. As the country became more thickly settled this system of feeding gradually disappeared, and it has not been practiced for the last ten years. During this time the cattle, instead of being kept in large herds by ranch and cattle men, have gradually become distributed among the farmers.

During the last few years the farms have increased in value and the area has become more prosperous. This change has been largely the result of the demand for land by Eastern buyers and prospectors.

CLIMATE.

The climate of southeastern Kansas is generally mild, equable, and healthful. In summer the thermometer often stands at or near 100° F., and sometimes slightly above, but a good breeze is generally blowing, which continues during almost the entire night, making it pleasant shortly after sunset. The prevailing wind in summer is from the south and southwest, while in the winter north and west winds are more common.

The winters are quite open till toward the latter part of December, after which the thermometer often falls below zero for a few days at a time, until the first part of February. The spring generally opens up early, allowing the farmers to begin preparing the soil for early crops about the middle of April.

During March and April high winds prevail, resulting in an occasional storm. July and August are generally very dry, and this forms one of the chief drawbacks to agriculture.

The growing season proper may be said to be from March 16 to October 5, which is about the average date for the last and first killing frosts in spring and fall, respectively. Even light frosts seldom occur after April 1.

The following table shows the normal monthly and annual temperature and precipitation, as compiled from Weather Bureau records at Sedan and Neosho, Kans. The former station lies about 50 miles west, and the latter about the same distance east of the area. The figures of rainfall differ considerably, but the data are the best attainable at the time of writing.

Normal monthly and annual temperature and precipitation.

Month.	Sedan.		Neosho.		Month.	Sedan.		Neosho.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	°F.	*Inches.*	°F.	*Inches.*		°F.	*Inches.*	°F.	*Inches.*
January	31.6	1.45	34.4	2.46	August	78.0	3.06	77.1	3.48
February	34.5	1.38	35.9	2.49	September	71.2	3.79	70.2	4.65
March	44.8	2.45	46.7	3.28	October	58.5	2.19	59.6	3.26
April	58.6	3.54	59.0	4.02	November	45.2	1.38	45.8	2.87
May	66.6	4.84	66.6	6.20	December	37.3	1.85	36.0	3.00
June	75.5	4.04	74.7	5.05	Year	56.8	33.31	57.0	44.71
July	80.0	3.34	78.2	3.95					

PHYSIOGRAPHY AND GEOLOGY.

A knowledge of the stratigraphic geology of the southern and southeastern parts of Kansas is important, as it has a direct bearing on the topography and soils of the area.

Along the southern boundary of the State the Mississippian formation dips to the westward at the rate of about 20 feet per mile. This

gives rise to an outcropping of the various overlying strata, permitting each to be exposed at the surface over a strip of country varying in width according to the depth of the layer.

The Cherokee shale, immediately overlying the Mississippian formation, varies greatly, both in character and color. It ranges from a fine-grained shale to a coarse sandy shale. Carbonaceous layers are also quite common in this formation. The color varies through black, gray, and greenish-gray to a peculiar ashy white, but the grayish shale predominates and gives rise to a soil grayish or ashy in color and with a peculiar silty texture.

The topography of the country covered by the Cherokee shale is slightly rolling, although many broad, comparatively level areas occur. The streams have neared their base level of erosion, and are now deepening their channels but little. Their valleys are level and extensive, and merge imperceptibly into the uplands, so that the line of demarcation is difficult to determine.

Above the Cherokee shale lies the Oswego limestone, a compact, solid rock of light-buff color, and rich in fossils. This system of limestone consists of two distinct strata, very similar in character, each varying in thickness from 10 to 20 feet, separated by a layer of black bituminous shale from 4 to 7 feet thick. The upper stratum of the limestone is the only one entering into the formation of a soil type in the Parsons area, broad areas of Oswego loam being formed from it in the western part of the sheet. It contains an abundance of chert or flint, broken fragments of which in some instances are found in the soil. Neither the lower layer nor the interlying shales enter into the formation of soils, except in depressions.

The Oswego limestone covers a comparatively narrow strip of country, and disappears beneath the overlying bed of shale to the westward. It is cut by numerous small streams and gullies, and presents a broken, rolling, and billowy topography. On the west bank of the Neosho River, where the underlying shales have been protected by this limestone, precipitous bluffs have been formed, some of which are over 100 feet high. Along the eastern limits of this system it presents in general a line of escarpments facing the southeast, from which the country slopes slightly to the westward.

The formation of next importance in the area is the Labette shale, which overlies the Oswego limestone. This bed of shale differs but little from the Cherokee shale. It is generally of a light, ashy color, and gives rise to a grayish-colored soil. The Oswego loam is derived from this shale as well as from the Cherokee. It will be noticed that the Labette shale follows roughly a continuous line. Like the Cherokee shale, it grades rapidly into sandstone, and from sandstone into shale again. This gives rise to the areas of Oswego fine sandy loam, with their rolling topography, occurring within the Oswego loam.

The Labette shale covers a comparatively narrow strip of country, presenting on the whole a slightly rolling topography, and having a slight slope to the westward from the western escarpments of the Oswego limestone.

SOILS.

There are in the Parsons area six types of soil, ranging from a clay to a fine sandy loam. The greater part of the area is made up of loams and clay loams. The extent of each of the types established is shown in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Oswego loam	92,096	36.2	Oswego fine sandy loam	9,728	3.8
Yazoo clay	68,544	26.9	Rock outcrop	2,368	.9
Sharkey clay	31,808	12.5	Total	254,464	
Yazoo loam	28,352	11.1			
Oswego silt loam	21,568	8.5			

OSWEGO SILT LOAM.

The peculiarities of the Oswego silt loam are very pronounced. Its white, ashy appearance, the level surface, and abrupt demarcations between the soil and subsoil are features at once noticeable, distinguishing the type in a marked way from the other types of the area. The surface soil to a depth of 12 inches is an ashy-white, fine, soft, flourlike silty loam, which changes abruptly into a stiff and very impervious drab to reddish-colored silty clay, locally known as "hardpan."

This type is found principally in the extreme eastern part of the area, occupying a section of country noticeably level, but with a slight slope to the westward. Considering its level surface, the drainage is remarkably good, the soil in no instance being too wet for cultivation.

The exact origin of this soil is as yet largely a matter of conjecture. Although it lies in the region of the Cherokee shale, and though the material of which it is composed is doubtless largely or wholly derived therefrom, yet the uniform depth of the soil and pronounced line of demarcation between the soil and subsoil, its level surface, the layers of waterworn gravel from 15 to 20 feet below the surface, and, in places, the silty and mottled nature of the subsoil, suggest the possible action of water and perhaps of wind.

When wet the soil is not sticky, though the particles pack together closely, but when dry it becomes very compact. If plowed in this condition it breaks up into large clods, which on further preparation for the crops are easily broken down into a loose, powdery condition.

Because of the impervious nature of the subsoil this soil suffers little from leaching; and the effects of an application of fertilizers or manures, especially the latter, are noticeable in the crops for several

succeeding seasons. Proper cultivation and fertilization would bring this type to a much higher standard of productiveness.

Where the subsoil has been mixed with the soil it has been noticed to have a beneficial effect on the crop yields. Subsoiling in the fall of the year would doubtless bring good results. The productiveness of the soil might be greatly increased, also, by plowing under some leguminous crop, such as cowpeas, soy beans, or clover. These would not only act as a fertilizer, adding nitrogen to the soil, but would also improve the texture and water-holding power of the soil by increasing the organic matter, a constituent which is now greatly deficient. Cowpeas seem to do well on this type, whereas it is difficult to get a good stand of clover or of the cultivated grasses, which give only a spindling growth, and soon dry out and wither.

The principal crops grown on this soil are wheat, corn, and wild hay, with fairly good yields of melons and sweet and Irish potatoes of a good quality. Oats do fairly well. The average yields per acre are as follows: Wheat, 15 bushels; corn, 25 bushels; and oats, 15 bushels. Flax was formerly grown, but only a very small acreage is now planted to this crop. The yield is about 10 bushels of seed per acre. The yield of wild hay ranges from 1 ton to 1½ tons per acre.

The Oswego silt loam is not a strong soil and ranks lower in price and productiveness than any of the other types. It sells generally for from $20 to $30 an acre, which seems to be higher than its productiveness would warrant. It is better adapted to wheat than to any of the other crops grown in the area, but even with wheat, commercial fertilizer, costing about $1.25 an acre, is used on this soil, while none is deemed necessary on the other soils.

The following table shows the texture of typical samples of the soil and subsoil of the Oswego silt loam:

Mechanical analyses of Oswego silt loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9340	8½ miles SE. of Oswego.	Silty loam, 0 to 12 inches.	1.21	0.30	0.42	0.34	1.86	9.58	74.06	13.22
9338	5½ miles NE. of Oswego.	Silty loam, 0 to 14 inches.	1.46	.34	.68	.46	1.74	10.98	71.20	14.30
9342	4½ miles E. of Oswego.	Silty loam, 0 to 12 inches.	1.91	.24	.58	.48	2.10	9.70	71.10	15.80
9343	Subsoil of 9342.....	Brown silty clay, 12 to 36 inches.	.42	.28	.78	.62	1.98	4.94	66.00	25.40
9341	Subsoil of 9340.....	Silty clay, 12 to 36 inches.	.85	.18	.40	.24	1.34	6.02	65.90	25.88
9339	Subsoil of 9338.....	Stiff silty clay, 14 to 36 inches.	.64	.08	.24	.22	1.42	5.00	63.20	30.06

OSWEGO LOAM.

The Oswego loam is a very important type in this area, both agriculturally and in the extent of territory that it covers. In its typical form it consists of a gray to yellowish silty loam, 0 to 10 inches deep, which grades into a stiff clay, becoming stiffer and more impervious as the depth increases. When dry the soil becomes hard and compact and has a tendency to bake and crack, but it is easily broken up into mellow loam, unless plowed in a very wet condition. It is apt then to bake and form compact masses which can be pulverized only by thorough harrowing or disking.

There are a few small areas of this type which vary slightly from the typical form, as the character of the shale from which this soil is produced changes. In places where the rock becomes an arenaceous shale or sandstone, it gives rise to a soil intermediate between the Oswego fine sandy loam and the Oswego loam. The soil in such areas contains a small, though variable, quantity of very fine sand.

Another slight variation occurs where limestone and a thin layer of shale overlying it have both entered largely into the formation of the soil. This gives rise generally to a reddish soil, somewhat heavier than the typical Oswego loam; but the difference in color, texture, and agricultural value is not great enough, nor are the areas of sufficient extent, to warrant distinction being made between this and the true type.

The Oswego loam occurs in almost every part of the area surveyed, being one of the most common of the prairie soils. The largest unbroken body occurs in the northwestern part of the area. It is distinctly an upland type, and is found occupying the gently rolling prairies. However, in a few instances this soil occurs in depressions where the strata of limestone capping the surrounding ridges or elevations have been removed.

The topography of the country embraced by this type is of such a nature as to insure good drainage, being somewhat rolling and of sufficient altitude above the level of the streams to protect it from inundation during floods. The streams flowing through it are numerous enough to remove quickly the excess of water and to keep the fields free from surface accumulations at all times.

The Oswego loam is derived from the weathering of the underlying rock, this usually being the Cherokee or Labette shale, with here and there a thin, interbedded layer of sandstone, limestone, and, in places, small outcrops of bituminous coal.

The soil is recognized as one of the less productive of the area, but is fairly well adapted to general farming. With proper cultivation and general fertilization, such as has been suggested for the Oswego silt loam, it can easily be brought to a much higher state of productiveness.

The main crops at present cultivated on this type are wheat and corn, though oats, flax, rye, and potatoes are also grown and do well. Clover and timothy are grown, though not very successfully. Alfalfa does not do so well as on the Sharkey clay, the Yazoo clay, and the Yazoo loam. The average yield per acre of wheat is 15 to 20 bushels; of corn, from 25 to 30 bushels; of oats, about 25 bushels, and of potatoes from 80 to 100 bushels. Flax and rye are not generally grown.

Farms on this type of soil generally bring from $20 to $35 an acre, depending upon the location and the state of improvement.

The following table gives mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Oswego loam.

No.	Locality.	Description.	Organic matter,	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9332	7 miles SE. of Parsons.	Silty loam, 0 to 10 inches.	2.65	0.66	1.76	0.84	3.64	15.78	61.12	16.20
9328	8¼ miles SW. of Oswego.	Gray silty loam, 0 to 12 inches.	1.52	.70	1.44	1.06	9.38	22.62	48.40	16.24
9330	5 miles NW. of Oswego.	Gray silty loam, 0 to 10 inches.	2.36	.64	1.46	.76	1.48	13.28	62.42	19.80
9329	Subsoil of 9328.....	Yellow silty loam, 12 to 36 inches.	.81	1.32	2.06	1.04	9.40	18.68	42.80	24.70
9333	Subsoil of 9332.....	Loam, 10 to 36 inches	1.57	.52	1.32	.76	2.82	10.94	55.10	28.50
9331	Subsoil of 9330.....	Stiff loam, 10 to 36 inches.	1.15	.26	.68	.42	1.00	8.34	59.20	30.12

OSWEGO FINE SANDY LOAM.

The Oswego fine sandy loam is a rather unimportant type as regards extent, and is generally esteemed one of the less productive soils of the area. However, it possesses some very desirable features lacking in the other soils.

The surface soil consists of a yellowish-brown heavy fine sandy loam, 12 inches in depth, the sand constituents of which are very fine, rendering the texture of the soil loose and loamy. The subsoil from 12 to 36 inches consists of about the same material, of a slightly more yellowish color and somewhat heavier in texture.

The Oswego fine sandy loam is easily cultivated, lacking the quality of compactness found in the other soils of the area. It warms up early, and can usually be prepared for crops before any of the other types. This is an especially good feature in the growing of oats, which, to escape rust, must in this section be sowed during the latter

part of February. Corn may also be planted earlier on this type, and, in fact, all spring crops get an earlier start than on the heavier types.

This soil covers a comparatively small part of the area. The largest unbroken body occurs about 4 miles east of Parsons. Another area almost as large is found about 4 miles northeast of Labette. A few other minor areas occur in the southwestern part of the survey, making in all about 12 square miles.

It is distinctly an upland type, and presents a rolling topography, occurring on rounded knobs and somewhat elongated ridges, which are cut here and there by erosion. These rise from 15 to 40 feet above the surrounding country. Because of the rolling surface, the natural drainage of the type is especially good. The subsoil, too, is not so impervious as are those of the area generally.

The Oswego fine sandy loam is derived from the weathering of the sandstones or arenaceous shales which underlie the soil some feet below its surface. As has been said, it is a characteristic of the Labette and Cherokee shales to grade into arenaceous shales and sandstones, which do not persist over wide areas, but disappear or pass again into the normal mud shale. This accounts for the patchy occurrence of the soil derived from these formations. As erosion has progressed these layers, which are more resistant than the ordinary shale, have been exposed, thus giving rise to the rolling topography, through weathering and decomposition.

The most typical areas of this soil are derived from a fine-grained sandstone. The cementing of this sandstone is usually very imperfect, which causes it to weather readily.

The most important crops grown are corn and oats, and the yields per acre obtained are: Corn, from 20 to 30 bushels, and oats, 25 bushels. Very little wheat is grown, the soil being so light that the crop winterkills. The soil is better adapted to truck and fruits than any of the other types of the area. These crops, however, are very little cultivated on account of the limited extent of the type and the distance from good markets.

The following table of mechanical analyses shows the texture of soil and subsoil of this type:

Mechanical analyses of Oswego fine sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9334	10½ miles SW. of Oswego.	Fine sandy loam, 0 to 14 inches.	1.31	0.14	0.86	1.10	26.08	31.18	29.30	11.14
9336	4 miles NW. of Labette.	Brown sandy loam, 0 to 12 inches.	2.17	.12	.38	.22	16.60	30.78	34.72	17.10
9335	Subsoil of 9334.....	Sandy loam, 14 to 36 inches.	1.19	.28	.76	.86	25.02	28.96	29.60	14.30
9337	Subsoil of 9336.....	Brown sandy loam, 12 to 36 inches.	2.02	.12	.64	.32	17.36	28.96	32.90	19.70

YAZOO LOAM.

The Yazoo loam, both in extent of area and in agricultural value, is an important lowland type. The surface soil consists of heavy gray to dark-gray silty loam, about 10 inches in depth. The subsoil from 10 to 36 inches is a gray or yellowish silty loam, more compact, and in places slightly heavier than the soil.

This type occurs associated with the Sharkey clay in the Neosho bottom and adjacent areas along the smaller tributaries of the Neosho River, being more common along the tributaries than the clay, while the clay predominates along the Neosho. Like the Sharkey clay, this is an alluvial deposit, being composed of the coarser silt particles, while the clay is formed of the finer particles.

While these soils are of nearly equal agricultural value, the Yazoo loam has the advantage of being more loamy and easy to cultivate. It does not clod when plowed, and does not bake or crack, as does the Sharkey clay.

The Yazoo loam is found frequently near the streams, on the natural levees which all overflowing streams build on their immediate banks, but it often occupies broad areas of bottom where the curve in the stream and other conditions of the current have been favorable to the deposition of the larger silt rather than the clay particles. These areas are also often largely influenced by the adjacent silty upland types, from which they have doubtless received large additions of material. In a few instances the material seems to have come largely from the upland types. The materials forming this type as a whole seem largely of local origin.

The Yazoo loam is subject to frequent overflow, which is the chief factor adversely affecting its value as a soil for agriculture in this area. It is a very productive soil, however, and when not subject to overflow is the best soil in the area for all the general farm crops.

The topography of this type is about the same as that of the Sharkey clay, both these soils occupying the low, level bottom lands. Although it is often slightly higher than the clay soil, the difference in elevation is not enough to give it any decided advantage in the case of floods. However, the difference is sufficient to make the natural drainage slightly better, as far as ordinary rainfall is concerned. There are some areas where underdrainage would be very beneficial.

It is found best to confine the use of this soil to the production of corn, alfalfa, and grass, as these crops are least injured by the floods, which usually occur early in the season. Often, however, the first planting of corn is totally destroyed, and the fields have to be reseeded. If this does not occur too late the crop proves almost as good as where first plantings are successful.

The crop value of this type is about the same as that of the Yazoo clay. It produces per acre from 40 to 50 bushels of corn, from 5 to 6½ tons of alfalfa hay, from 1 ton to 1½ tons of timothy, and from 1½ to 2 tons of clover hay. Lands of this type bring from $30 to $40 an acre.

The following table shows the texture of typical samples of this soil:

Mechanical analyses of Yazoo loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9310	3 miles NE. of Oswego.	Brown silty loam, 0 to 12 inches.	3.02	0.20	0.46	0.46	2.76	14.76	60.20	15.02
9308	2¼ miles SW. of Oswego.	Silty loam, 0 to 12 inches.	2.42	.32	.90	.46	2.46	16.86	62.20	16.80
9309	Subsoil of 9308.....	Gray silty loam, 12 to 36 inches.	1.24	.18	1.22	.50	1.74	15.14	58.50	22.36
9311	Subsoil of 9310.....	Brown silty loam, 12 to 36 inches.	1.42	Tr.	.04	.08	.58	14.56	57.68	27.06

SHARKEY CLAY.

The Sharkey clay is one of the strongest soils in the area. The surface soil consists of a stiff, waxy black clay from 0 to 10 inches deep and rich in organic matter. The texture is heavy and tenacious; the surface becomes very hard when dry, and the soil is cultivated with difficulty. If plowed in a wet condition it bakes to a bricklike hardness. In dry weather cracks are produced, often a foot or more in

depth. This tendency to crack is also noticeable when the broken soil is exposed to the sun after a rain.

The subsoil from 10 to 36 inches is a stiff drab clay, differing from the soil mainly in the amount of organic matter present, the proportion of which decreases with depth. The color also grows lighter as the depth increases. This type, owing to its stiff, waxy nature, is locally known as "gumbo" soil.

The Sharkey clay lies mainly in the broad bottom of the Neosho River and is the principal type of bottom land. The surface, as would be expected in a broad bottom, is quite level, but cut in places by sloughs and old river courses which have been left as the river changed its meandering channel. Swampy conditions prevail in some areas.

The natural drainage of this soil is very poor, on account of its flat surface and generally slight elevation above the level of the stream. This location subjects it to frequent overflow, and while most of the area can be well drained, under ordinary conditions the drainage system now in use is inadequate to protect the crops under cultivation from complete destruction in case of any considerable rise in the streams. In the vicinity of Chetopa broad areas of this type exist, on which no crop can be grown except native hay, because of poor drainage and frequent overflow, and even this crop can not be harvested on some of these areas in a comparatively wet season. Some systematic work in the way of straightening the river channel, keeping it free from shoals and other obstructions, or by constructing dikes, would do much to lessen the frequency of overflow and thus remove, at least in part, the greatest drawback to the cultivation of this very productive type.

The materials of which this soil is composed are chiefly derived from the upland types and the shales and limestones which have produced them. These have been carried down in suspension by the river and deposited in times of overflow.

When well drained the Sharkey clay will produce almost any crop grown in this area, but because of the liability to overflow it is found practicable to grow only corn and grass. These crops are often seriously damaged, although a second crop of corn is often successfully grown after the destruction of the first.

Taking one year with another, the farmers secure from 40 to 50 bushels of corn, from 1 ton to 2 tons of wild hay, 1½ tons of clover, 6½ tons of alfalfa, and from 1 ton to 2½ tons of timothy hay per acre.

The greater part of this type was at one time covered with timber, but much of it has been cut off. The predominant growth is red oak and a few other hardwoods. There are several good pecan groves yet in existence along the river and smaller streams.

The Sharkey clay is especially adapted to the production of corn, wild grass hay, clover, and alfalfa. The price of this soil varies

according to its location, and condition as regards drainage. Where well drained it can be bought for $30 or $40 an acre. Where no attempt has been made to drain and reclaim it the price is much lower.

The following table of mechanical analyses shows the texture of typical samples of this soil:

Mechanical analyses of Sharkey clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P ct.*
9316	2½ miles NE. of Oswego.	Black clay, 0 to 12 inches.	1.68	0.10	0.68	0.70	3.40	5.12	55.60	33.94
9312	4½ miles NE. of Chetopa.	Black clay, 0 to 12 inches.	2.15	.56	.68	1.24	5.60	6.36	40.30	45.34
9314	1½ miles SW. of Chetopa.	Black clay, 0 to 10 inches.	3.93	.62	1.28	.78	2.90	2.78	41.90	49.36
9317	Subsoil of 9316.....	Drab clay, 12 to 36 inches.	1.72	.20	.76	.60	1.50	4.34	61.20	30.86
9313	Subsoil of 9312.....	Dark stiff clay, 12 to 36 inches.	.82	.32	1.26	1.96	8.90	8.76	45.28	33.40
9315	Subsoil of 9314.....	Brown stiff clay, 10 to 36 inches.	.97	0.00	.66	.70	3.98	3.60	47.40	43.42

YAZOO CLAY.

The Yazoo clay is a black, dark-brown, or reddish clay loam, about 8 inches in depth, underlain to a depth of 36 inches by a stiff, tenacious, and rather impervious dark-drab, dark-yellow, or reddish-brown clay, becoming red in places where the limestone rock comes near the surface of the soil, or contains a relatively high percentage of iron.

In many places the underlying rock is encountered at a depth of from 8 to 12 inches. This thinness of the soil covering generally occurs on the slight slopes, and is more common as the river is approached from the southwest, along the small streams, and near the areas shown on the map as rock outcrop. On such areas the nearness of the parent rock to the surface causes crops to suffer severely during prolonged droughts.

Because of the presence of slowly weathering chert in the Oswego limestone, the soil in places contains varying quantities of fragments of this material. These rocky areas are usually small, and are very seldom a hindrance to cultivation, generally occurring along the edges of depressions which have been formed by erosion. The presence of these fragments is most noticeable near the river on its west bank.

The broadest body of this type occurs in the southwestern part of the survey, from whence it may be traced across the area by a roughly

marked, disconnected, and irregular path, along which the peculiar dip of the strata has permitted the Oswego limestone to come to the surface. This layer of massive, semicrystalline limestone has been cut by the Neosho River and numerous small streams, thus disconnecting the areas of the derived type of soil and giving rise to narrow strips and broader areas of lowland or bottom soils across it. In some instances the limestone has been removed and the underlying shales exposed, giving rise to the Oswego loam in the breaks in this type. However, its path is plainly marked and easily recognized. Varying in width from 3 to 8 miles, it indicates the most prosperous agricultural district in the area. A few small bodies of the type occur in the extreme western and northwestern parts of the area south and east of Parsons. These lie outside of the area of general distribution, and are derived from another layer of limestone. East of Parsons the soil is of lighter color, and less productive than in the typical areas.

The Yazoo clay when rightly handled is easily cultivated and generally gives a mellow seed bed, though if tramped by stock in the spring or if plowed when too wet it breaks up into cloddy lumps, bakes, and is rather lifeless. In extremely dry weather, also, it cracks to some depth.

This type is found occupying the rolling uplands of the prairie. It presents in general a billowy topography, which in places rises into hills from 30 to 50 feet high. On the whole, it has a more broken and rolling surface than any of the other soil types, and the natural drainage is especially good, there being very few places where it is necessary to drain the fields artificially. It is the most productive soil of the upland types and compares favorably with other limestone soils of the country. In the immediate area it is recognized to be worth from $2 to $5 more an acre than any other of the upland types, and it will produce from 2 to 8 bushels more per acre of corn and wheat, with the prevailing methods of cultivation. It is especially adapted to corn, yielding from 25 to 35 bushels per acre, which yield could be greatly increased if proper and thorough cultivation were given. Wheat yields from 15 to 18 bushels per acre. Oats are not successfully grown, as they produce too large a growth of straw and too little grain. Alfalfa, clover, and timothy do well on this soil, and although alfalfa is not extensively grown, good fields of this and of timothy and clover may be seen here and there. These crops grow better on this than on any of the other upland types, and during favorable seasons will produce an average of 4 or 5 tons per acre of alfalfa and from 1 ton to 2 tons of clover. In ordinary seasons, however, the soil is in many instances too shallow and does not afford a sufficient water supply for alfalfa. Timothy is not often grown, except when mixed with clover.

The Yazoo clay, if well improved and in a good location, brings from $30 to $45 an acre.

The following table of mechanical analyses shows the texture of the soil and subsoil of this type:

Mechanical analyses of Yazoo clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9318	8½ miles SW. of Oswego.	Black clay loam, 0 to 12 inches.	5.57	0.62	1.36	0.78	1.90	12.16	56.26	26.66
9322	6½ miles SW. of Oswego.	Silty loam, 0 to 10 inches.	2.27	.68	2.66	1.62	4.20	11.24	51.80	27.80
9320	3½ miles N. of Oswego	Black clay loam, 0 to 10 inches.	1.48	1.46	2.60	1.80	4.24	10.10	46.20	33.60
9319	Subsoil of 9318.....	Clay, 12 to 36 inches.	1.73	1.10	2.06	1.06	2.66	10.68	48.72	33.72
9323	Subsoil of 9322.....	Clay loam, 10 to 30 inches.	1.55	1.82	3.48	1.66	4.62	8.12	35.30	44.96
9321	Subsoil of 9320.....	Yellow clay, 10 to 36 inches.	1.22	1.28	2.28	.96	3.54	6.02	36.30	49.42

ROCK OUTCROP.

Certain areas are shown in the accompanying map, uncolored and marked by symbol. These represent areas of outcropping rock or areas covered by stones and bowlders to such an extent as to be unfit for agriculture. There are something over 2,300 acres of such land in the area.

ALKALI IN SOILS.

Throughout this area, in practically all types of soil, are occasional spots of one-fourth to 1 acre in area which have a whitish or grayish appearance, very scanty vegetation, and occasionally a slight surface crust. The material composing this crust seems to be quite uniform, and two samples of the subsoil from one of these spots which appeared to be typical were forwarded to the laboratory for examination. The quantities of the water-soluble constituents are given in the following table:

Chemical analyses of alkali subsoils.

Constituent.	9326. 7¼ miles SW. of Oswego; subsoil, 12 to 24 inches.	9327. 7½ miles SW. of Oswego; subsoil, 24 to 36 inches.
Ions:	*Per cent.*	*Per cent.*
Calcium (Ca)	17.83	13.53
Magnesium (Mg)	1.87	1.77
Sodium (Na)	6.56	12.69
Potassium (K)	4.31	2.42
Sulphuric acid (SO_4)	67.56	66.24
Bicarbonic acid (HCO_3)	1.87	3.35
Conventional combinations:		
Calcium sulphate ($CaSO_4$)	60.60	45.98
Magnesium sulphate ($MgSO_4$)	9.28	8.76
Sodium sulphate (Na_2SO_4)	18.04	35.19
Sodium bicarbonate ($NaHCO_3$)	2.60	4.66
Potassium sulphate (K_2SO_4)	9.48	5.41
Per cent soluble	1.92	2.14

It will be seen that these subsoils contain approximately 2 per cent of water-soluble salts, of which, however, about one-half is calcium sulphate. Nevertheless, from the experience of the Bureau in other areas where alkali has been studied, the amounts of soluble salts shown by this table are sufficient to prove seriously inimical to the growth of ordinary cultivable plants. However, underdrainage and thorough cultivation of the soils should readily effect the reclamation of these patches of soil.

It is noticeable that the figures do not show the presence of chlorides, since these substances are too slight in amount to be estimated, and the character of the alkali, as shown by the analysis, is one of the less harmful kinds to plants, so that its reduction to safe limits and the reclamation of the soil should prove comparatively easy. In fact, the existence of these alkali spots has no great significance other than a warning of possible bad results from careless or faulty soil management.

AGRICULTURAL CONDITIONS.

The Parsons area lies in a section of country which, though somewhat undeveloped, is naturally well suited to the growth of a prosperous agricultural industry. Its soils, with but few local exceptions, are naturally strong and well adapted to the production of most ordinary farm crops, and the possibility of improving them by proper methods of agriculture is unmistakably great. The mild climate makes it a region well suited to stock raising. Up to the present time, however, progress has not been so great as natural conditions seem to warrant, nor is the agricultural class in as prosperous a state as it would seem it should be. About 50 per cent of the farms are mortgaged at about one-third of their value, but each year these incum-

brances are being reduced. About 90 per cent of the new mortgages are given to reduce the old ones or for the purpose of buying more land. Possibly three-fourths of the bank deposits belong to the farming class.

The farm buildings consist of a fairly good house, but generally a small and poorly built barn. There are exceptions, however, in the more wealthy and better-developed communities, where large, well-built houses, barns, and sheds are seen.

Probably 60 per cent of the farmers own the farms they operate. Those who rent generally pay one-third of the crop, with from $20 to $70 in cash, as a "privilege" rent, according to improvements and the amount of pasture land on the farm. Only a few pay a cash rental, the customary rate being $1.50 or $2 an acre. Rents in general are advancing.

There are but few large tracts of land under single ownership. The average size of the farms is 160 acres, which, under existing conditions, is much too large. The methods of agriculture are very imperfect and crops are poorly tended. There is no system of rotation practiced in the area, as many as 23 consecutive wheat crops having been harvested from one field. The soil is generally poorly prepared for all crops. Very little of the barnyard manure is spread on the fields; it is commonly left about the barns to waste. Smaller farms, say of 80 acres, well cultivated and cared for, would do much to put the agriculture of the area on a firmer, better-paying basis.

The State reports for recent years show an increase in the number of all kinds of live stock kept in the area, and indicate that it is more evenly distributed among the farmers than formerly. However, there is great need for more farm animals throughout the country, and the present system of keeping almost all the land under cultivation should be discontinued and the area of pasture land should be extended. The country is well adapted to grazing.

The farm labor of the area is mostly American, and trustworthy. It is, however, very difficult to secure, and this is becoming a very serious problem with many of the farmers. Many of them are cutting down their acreage of cultivated land on this account alone. Formerly there were plenty of good laborers to be had, but the greater demand and the better wages paid in the towns and cities and near-by mines have drawn many men from the farms. Many, too, during the development of the country, have purchased farms for themselves. There is some available colored labor, but at the same wages most farmers give preference to white labor. There is a great demand for hands during harvest, when from $1.50 to $2 a day is paid, with board in addition, but the harvesting season is too short to attract much transient labor. When hired by the month farm hands receive from $15 to $20 and board.

The principal crops are corn, hay, wheat, and oats. Oats are not extensively grown, however, and the output of wheat is not sufficient to supply the demand of the rather extensive local milling interests, so that much is shipped in from more western counties. Alfalfa can be quite successfully grown, especially in the bottoms which are not subjected too frequently to overflow. The acreage of this crop is increasing from year to year. Millet and Hungarian grass are grown by many of the farmers, and yield from 1 ton to 2½ tons of hay per acre. Sorghum is largely sown for forage purposes. Kafir corn constitutes a rather important crop. The main crop of the area, however, is corn, most of which is fed to stock or used by the local mills.

As a whole, the soils of the area are well adapted to the production of nearly all ordinary farm crops, but some seem better adapted to certain crops than to others now grown in the area. The Sharkey clay and the Yazoo loam are especially suited to corn, alfalfa, red clover, millet, and Hungarian grass. The Yazoo clay is likewise well adapted to corn and clover, but not so well to alfalfa as the two types just mentioned. The Oswego loam and the Oswego silt loam give the best results when farmed to wheat, but fairly good crops of corn are grown also. The Oswego fine sandy loam is better adapted to truck and fruit than any of the other types, but also produces good crops of corn.

There are no macadamized roads in the area, and the material used in road construction is generally the stiff clay subsoil. The roads are good the greater part of the year, but a wet, open winter followed by a wet spring makes them very difficult to travel, even with empty vehicles.

The principal stock market for the area is Kansas City, while the products of the mills are shipped to the south and southeast. There are seven elevators and six modern flouring mills in the area. One railroad, the Missouri, Kansas and Texas, runs north and south through the area, and three, the Missouri Pacific, St. Louis and San Francisco, and a branch of the Missouri, Kansas and Texas, run east and west, one through the northern, one through the central, and the other through the southern part of the area. These afford eight principal shipping points within the area.

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U.S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF.

SOIL MAP

KANSAS
PARSONS SHEET

Soils surveyed by
J. A. Drake
1903.

BASE MAP ENLARGED AND REDRAWN FROM
U.S. GEOLOGICAL SURVEY SHEET

Scale 1 inch = 1 mile

Field Operations
Bureau of Soils
1903.